U. S. FOREST SERVICE

RESEARCH NOTE NC-22

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

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Establishing Grass Range In the Southwest Missouri Ozarks

ABSTRACT.—Prescribed burning to prepare a seedbed, seeding native grasses or fescue on proper sites, and fertilizing are all necessary for successfully establishing good grass production where trees have been killed by aerially applied herbicides.

Ozark cattlemen have become increasingly interested in creating pasture and range by aerial spraying of chemicals to kill trees and other woody plants. Since 1950, by conservative estimates, they have sprayed between 1½ to 2 million acres for this purpose. In 1966, approximately 250,000 acres were sprayed in Oklahoma, Missouri, and Arkansas.

Each year interest mounts. Beef demand and price have increased. Costs of spraying an acre have decreased with improved techniques and increases in amount of area sprayed. In 1966, a number of landowners near Ava, Missouri, organized and contracted for a first spraying of 11,000 acres by helicopter at $5 per acre. Lower conversion costs and higher beef prices have stimulated interest so that we expect even more acreage to be sprayed in 1967.

Brushland can be converted to good grassland at low cost by aerial spraying, but it is also easy to make costly mistakes. If conversion from trees to grass is not done properly and then maintained properly, the sprayed area will revert to a dense sea of hardwood sprouts that are much more difficult to eliminate than the original stand of trees. Broomsedge, less palatable and more deficient in nutrients than fescue, Indiangrass, switchgrass, big bluestem, or little bluestem, will reseed an improperly converted area and hinder establishment of desirable grasses. The purpose of this paper is to explain briefly how certain areas producing little or no wood of commercial value can be converted to productive grassland.

What Was Done

To find out how to properly convert low-quality hardwood stands to good grass cover, the North Central Forest Experiment Station, in cooperation with the Agricultural Research Service, established several study plots on the Mark Twain National Forest near Bradleyville, Missouri. Plots were located on (1) shallow soil on south and west facing upper slopes, (2) deep soil on south facing lower slopes, and (3) shallow soil on north and northeast facing upper slopes. Sites were classified by their ability to grow black oak. The upper south slopes have a black oak site index of 35, which means a dominant black oak grows 35 feet tall in 50 years. Black oak site index for lower south slopes is near 45, and that for north slope sites is near 55.

These plots were similar to many low-quality hardwood stands in this part of the Ozarks. Overstory trees were primarily post and blackjack oak with some black and white oaks on better sites. Crown cover was almost complete except for strips of overgrazed open glades on the upper south slopes. Understory plants were sparse: primarily shade tolerant poverty oatgrass, sedges, and panic grasses, with scattered clumps of more desirable forage species such as little bluestem. Soil depth and type differed greatly within a small area; Corydon, Baxter, Linker, Hobson, and Gasconade soils were found on the study area.

The study areas were aerially sprayed with 2,4,5-T in July 1959 and June 1961. The second spraying was considered necessary in view of the poor defoliation of trees and brush (less than 65 percent) obtained from the first application. One-half gallon of 4 pounds acid equivalent per gallon herbicide in 4.5 gallons of fuel oil was applied per acre in each application. Half of each plot was burned in August and September 1959 for seedbed preparation. Sprayed plots were seeded by hand broadcasting with (1) a

mixture of 24 pounds of K-31 fescue and 3 pounds each of Korean and sericea lespedeza per acre in September 1959, and an additional 8 pounds per acre of fescue in early March 1960, or (2) a native grass mixture of 7 pounds of little bluestem and 3.5 pounds each of big bluestem, Indiangrass, switchgrass, and side-oats grama per acre in late February and early March 1960, or (3) left for natural seeding. An 8-24-8 fertilizer was applied to some of the plots at the rate of 320 pounds per acre in March 1960.

What We Learned

Prescribed burning to prepare a seedbed, seeding native grasses or fescue on proper sites, and fertilizing are all important for efficiently and successfully establishing good grass production on sprayed areas (fig. 1).

Figure 1.— Prescribed burning (left) to prepare seedbed is essential for the successful establishment of a good stand of grass compared to no burning (right). Both areas seeded with native grasses.

Sprayed but unseeded areas produced little desirable[1] grass (fig.2). At best, unseeded areas produced only one-third as much as burned, seeded, and fertilized plots. Even with a natural seed source, it took four growing seasons to produce over 700 pounds per acre of ovendry desirable grass; whereas, the burned, fertilized plots seeded to fescue produced over 700 pounds per acre the first growing season and most seeded native plots produced that amount after the second season (fig. 3). Quick revegetation is essential to prevent erosion and excessive runoff from heavy storms and can best be assured by full treatment. Most unseeded plots were without an adequate seed source and therefore failed to produce much more than 50 pounds per acre even when removal of overstory was followed by total protection from grazing for 7 years.

Fescue and native grass production after prescribed burning and fertilizing was greatest on north and east upper slopes (fig. 3). Fescue production exceeded natives in 1960 but decreased to less than 1 ton per acre in 1961 and 1962 due to drought. Native grasses, better adapted to drought, produced over a ton in 1961 and 2 tons in 1962. With better growing conditions in 1963, fescue yields increased to almost 2 tons per acre, about equal to native grass yields.

On lower south and west slopes yields of fescue were slightly greater than those of native grass in 1960 and 1961. In 1962 native grass yields increased substantially while fescue yields increased only slightly. This trend continued in 1963.

On upper south and west slopes, yields of native grasses and fescue were about the same in 1960 and 1961. By 1962 the native grasses had enough time to

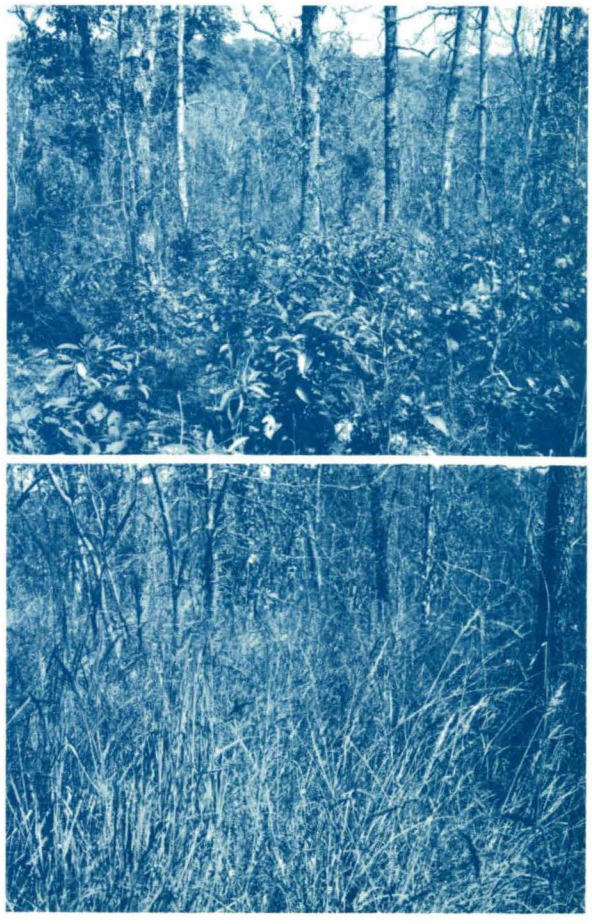

Figure 2.— Little desirable grass is produced on areas sprayed, burned, fertilized but not seeded (above) compared with sprayed, burned, fertilized, and seeded (below). Pokeweed, a poor livestock forage plant, is predominant in unseeded plot above. Indiangrass is most abundant in the seeded plot.

[1] *Desirable grass is little bluestem, big bluestem, Indiangrass, switchgrass, and side-oats grama grass.*

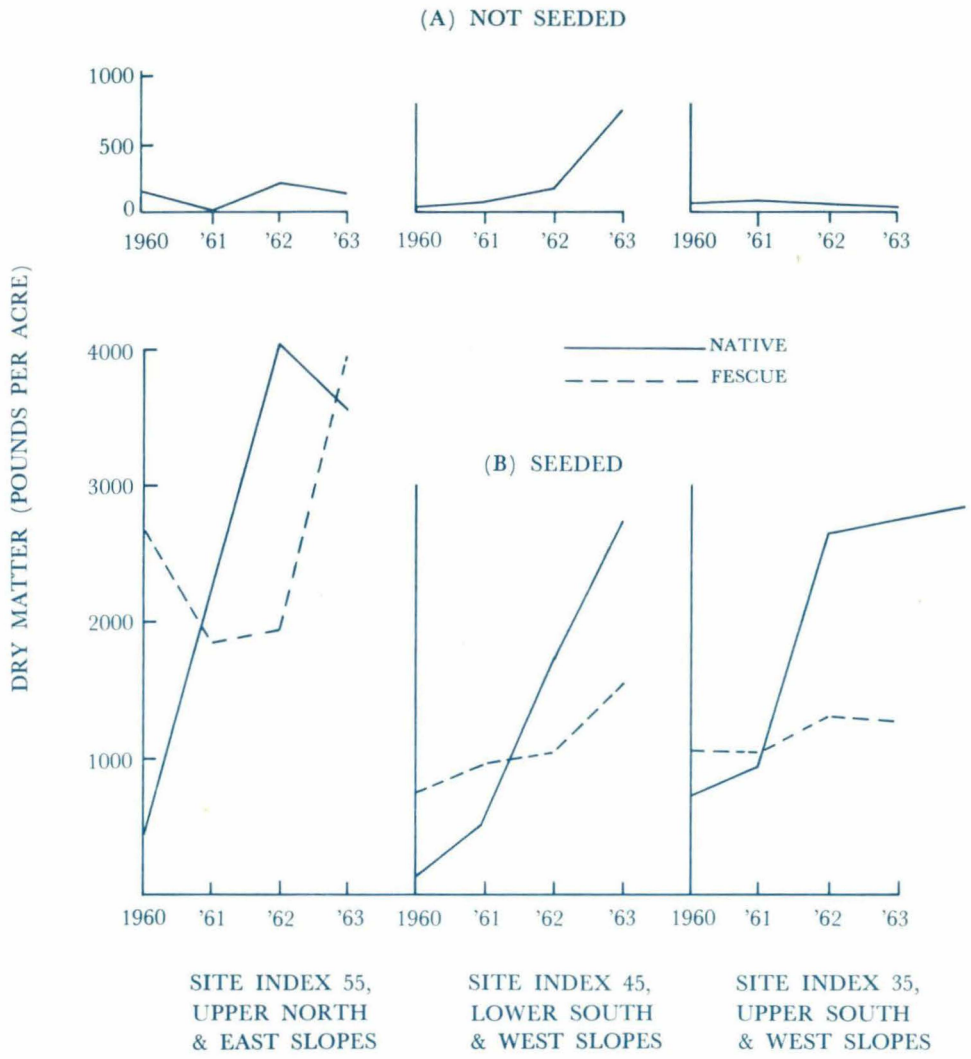

Figure 3.— Desirable grass production after spraying, burning, and fertilizing. (A) Not seeded, (B) seeded to native grasses or fescue.

develop an adequate root system and greatly outproduced fescue on these shallow soil, droughty sites. Native grasses continued to produce well into 1963.

No measurements were taken in 1964 and 1965. Measurements in 1966 show a substantial decline from the 1963 yields on all seeded plots. Several factors help account for this. Some larger trees that originally suffered great crown damage began to develop another crown. Basal sprouts increased in number and size. Grass litter increased greatly without grazing, clipping, or burning, and became so dense that new growth received only small amounts of light. Shade tolerant, poorer forage grasses increased under the grass litter.

Retreatment possibly at 3- to 5-year intervals will be necessary to control encroaching hardwoods. Grazing will prevent a heavy litter accumulation, but it will also reduce grass competition with hardwood sprouts unless grass is adequately and properly fertilized.

Recommendations

Much more must be learned before a complete set of recommendations on range establishment in the Ozarks can be published. We have investigated only three of many sites, and even on these sites we need more information — we especially need to know how to graze these sites best to keep the grass resource producing near its potential.

The type of land we studied with black oak site index from 35 to 55 offers a potential for a workable range operation. Upper south and west slopes should be seeded to native grasses. Our best producers were Indiangrass and switchgrass. Shallow-soil north and east slopes should be seeded to fescue to give a bal-

ance of cool- and warm-season grasses in nearby pastures. The lower south and west slopes will produce a greater volume of native grasses than fescue, but extra fescue will be needed for drought years, so deep soil areas on lower slopes which receive more runoff might be put into fescue. Because of differences in stem-to-foliage ratios, about 80 percent of the fescue plant is edible compared to about 60 percent edibility in the native grasses. This further strengthens the recommendation of fescue for better sites but does not change the recommendation on poorer sites.

Burning is necessary before seeding. Burning is tricky and must be done right or the effects may be bad rather than good. Much has been written in the Ozarks on preventing fires but little on properly using fire. The main objective of burning is to remove the dry leaf litter that prevents the light grass seed from reaching moist ground and germinating in a proper environment. The fire should not be so severe that it burns the nutrient-rich, moisture-retaining humus found between the leaf litter and mineral soil. Areas that have been burned yearly may not have a humus layer and would not be safe risks for conversion. Until we do more research, we cannot give a firm set of burning rules. However, some obvious precautions can be mentioned. Test burn a small spot. Remember, burning conditions can change rapidly, so conditions that are proper at 8:00 a.m. may be wrong or even highly dangerous at 9:00 a.m. Late afternoon or shortly before dark is often a good time. Get help and burn only small areas at one time. Have good fire lines and be careful. Fire, like any tool, when used improperly can be dangerous to man and land.

Fertilizer helps get the grass off to a good start. We have no information on fertilizer needs after grazing has started. Hilly rangeland presents a different fertilization problem from level pastures.

Grazing should be deferred at least 1 year after fescue seeding and 2 years after seeding native grasses. Fescue grassland will need to be fenced and managed separately from native grassland. Grazing too soon will ruin chances of getting a good grass stand, will increase hardwood sprouting, and will give a ground cover of undesirable and often poisonous plants.

The successful establishment of a grass stand does not ensure a lasting return. Mismanagement can quickly ruin an excellent pasture. Plants require the attention given to other living things. Excess removal of the top growth by continuous grazing weakens the plant and if continued may even kill it. *Periodic* rests of at least one growing season — June, July, and August for native grasses, and March, April, and May or September and October for fescue — after each season of intensive grazing will allow the plants to restore vigor and maintain maximum production. Fertility must be maintained or rest periods will do little good.

Livestock prefer some plants over others and graze them more heavily. A rest-rotation system whereby an area is intensively grazed for short periods of time —one growing season or less—encourages use of less preferred plants as well as preferred plants. During rest periods, the preferred species can recover equally with the less preferred. The rest-rotation system requires additional costs in management but gives more returns in the long run.

Last but not least, retreatment will be necessary. Because of the amount of rainfall in southwest Missouri, the natural plant succession is to woody growth, especially on north and east slopes with deeper soils—better tree sites. Respray intervals will depend on success of the initial treatment, type of management, rainfall, and site. Better tree-growing sites will probably grow more vigorous sprouts. If you skimp on proper management, it will cost more for retreatment. Killing sprouts is more difficult than killing fully grown trees. Do not fail to consider costs of retreatment in planning your operation.

April 1967

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